IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Reissue Application of	
U.S. Patent No. 5,788,864 (Issued August 4, 1998)	Art Unit: 1761
Application No. 09/632,812	Examiner: Chester T. Barry
Filed: August 4, 2000	Atty. Docket: 09323.00001
For: AMINE HEAT STABLE SALT REMOVAL FROM TYPE II ANION EXCHANGE RESIN	

DECLARATION OF DR. ARTHUR L. CUMMINGS UNDER 37 C.F.R. § 1.132

I, Arthur L. Cummings, declare as follows:

1. I am the Arthur L. Cummings named as an inventor of this application.

2. I earned a Ph.D. degree in Analytical Physical Chemistry from Brigham Young University in 1974. I have worked in the field of ion exchange since 1989. I am employed by MPR Services, Inc., the assignee of the original application and of this application.

3. Sellers of ion exchange resins make available to customers and potential customers various documents setting forth various properties and characteristics of the ion exchange products they sell. These documents are available from the sellers on request.

4. Some documents resin sellers make available contain information about a specific resin product. Other documents resin sellers make available contain information about ion exchange resin technology in general.

5. MPR Services is a purchaser of ion exchange resins and has received informational documents from resin sellers. Informational documents regarding ion exchange technology in MPR's possession include Documents A-O attached hereto. Each of these documents was received directly from a resin seller.

6. I have reviewed a copy of the Office Action dated March 20, 2003. It is my understanding that all claims of this application have been rejected on the basis that a skilled practitioner does not have fair notice of reasonably precise limits on the claimed invention because "the specification does not describe what a Type II resin is." Office Action, page 4.

7. In particular, the Office Action describes a difference between the disclosures of Crits, US 4,267,159, and Boone, US 5,846,883, on the one hand and Crovato, US 5,692,461, on the other. The Office Action also mentions Fig. 16-8 of Perry's Chemical Engineers' Handbook, Fifth Edition. A copy of pages 16-10 to 16-15 of Perry's Handbook, Fifth Edition, was provided with the Office Action. I have reviewed each of these patents and the Perry's Handbook, Fifth Edition, document.

8. Crits discloses at column 3, lines 39-45, that Type II strong base anion exchange resins have dimethylethanolamine for functionality, whereas Type I strong base anion exchange resins use trimethylamine for functionality.

9. The disclosure at column 13, lines 39-59, of Boone describes the functional group of Type I strong base anion exchange resin as three methyl groups attached to a nitrogen atom. Similarly, Boone defines the functional group of a Type II strong base anion exchange resin as having one of the methyls replaced by ethanol. Boone also includes the structural formulas of both types of strong base anion exchange resin.

Boone describes the same functionality as disclosed in Crits. These disclosures are consistent with information from sellers, as described in Documents A-O and in paragraphs 12-33 hereinbelow.

10. Crovato is rife with both technical errors and typographical errors; only the former will be considered herein. The description in Crovato, column 25, line 38, to column 26, line 45, is mistaken. The Type I strong base anion exchange resin structural formula contains an error (the moiety between the aromatic ring and the N atom should be $-CH_2-$, not $-CH_3-$, which would provide that C atom with 5 bonds, not a likely scenario). The description of the differences between Type I and Type II strong base anion exchange resins also is erroneous; this error is much more significant.

11. Crovato suggests that Type I strong base anion exchange resins are resins that have a Cl^- anion, whereas Type II has an OH^- anion. Column 25, lines 38-61. Crovato repeats this suggestion at column 26, lines 34-45, where he describes a preferred Type I strong base anion exchange resin as Sybron's IONAC® ASB-2HP in Cl^- form and preferred Type II strong base anion exchange resin as the same resin, IONAC® ASB-2HP, but in the OH^- form. Crovato's suggestion is in error.

12. Documents A-D attached hereto were received from Sybron Chemicals Inc. Document A (IONAC® ASB-1) is a fact sheet for Sybron's ASB-1 product. Document B (IONAC® ASB-1P) is a fact sheet for Sybron's ASB-1P product. Both products are Type I strong base anion exchange resins. The first paragraph of Documents A and B and the "Functional Structure" line in the box labeled "Typical Characteristics" of Documents A and B state that the functional group of these Type I strong base anion exchange resins is trimethylamine ($-N-(CH_3)_3^+$).

13. Document C (IONAC® ASB-2) is a fact sheet for Sybron's ASB-2 product, a Type II strong base anion exchange resin. The first paragraph of Document C describes the functional group of this Type II strong base anion exchange resin as a dimethylethanolamine group. This is illustrated on the "Functional Group" line in the "Typical Characteristics" box as follows:

$$AR\text{-}N(CH_3)_2{}^{+}X^{-}$$
$$CH_2CH_2OH$$

14. Each of Documents A-C also sets forth the degree of swelling expected when each resin is converted from the Cl^- form to the OH^- form. This indicates that both Type I and Type II strong base anion exchange resins exist in both the Cl^- form and the OH^- form.

15. Document D (Field Experiences with the Stability of Strong Base Resins at Corpus Christi Petrochemical Company) is a page of a document co-authored by Sybron employees. The left column of the page numbered 3 of this document illustrates the structural formulas of Type I and Type II strong base anion exchange resins generally (i.e., not limited to a particular product). As can be seen, Type I strong base anion exchange resins have a trimethylamine functional group, and Type II strong base anion exchange resins have a dimethylethanolamine functional group.

16. Document B is dated "12/89" at the lower right corner of the last page. Document C is similarly dated "12/89" at the lower left corner of the last page. Document D is dated "10/86" at the lower right corner of the last page. Thus, each of these documents predates both Crovato's earliest filing date and the earliest filing date of the original application herein.

17. Documents A-D directly contradict Crovato's suggestion regarding the difference between Type I and Type II strong base anion exchange resins because the documents show that both types of strong base anion exchange resins exist in both the Cl^- and the OH^- forms. The documents also contradict Crovato's suggestion because they show that the functional group of two Sybron Type I strong base anion exchange resins is trimethylamine and the functional group of a Sybron Type II strong base anion exchange resin is dimethylethanolamine.

18. Document D also contradicts Crovato's suggestion because it shows the chemical structures of Type I and Type II strong base anion exchange resins generally, i.e., not related to a specific Sybron product. This document therefore illustrates the difference between Type I and Type II strong base anion exchange resins. The difference between Type I and Type II strong base anion exchange resins lies in the structure of the functional group, not in whether the resin is in the Cl^- form or in the OH^- form.

19. Document E (DOWEX Ion Exchange Resins) describes generally strong base anion exchange resins sold by Dowex in the paragraph bridging the columns of the page numbered 4. There, Type I strong base anion exchange resin is described as incorporating quaternary methylamine as the functionality. This is chemically and structurally the same as stating that the functional group is trimethylamine. (The fourth bond with the N that forms the quaternary methylamine is the bond to the backbone of the resin polymer.) Document E describes Type II strong base anion exchange resin as using a dimethylethanolamine group. This document is dated 1987, as can be seen at the lower right corner of the last page and in the first line of the last paragraph therein.

20. Document E contradicts Crovato's suggestion and shows that the difference between Type I strong base anion exchange resin and Type II strong base anion exchange resin lies in the structure of the functional group. Document E also enables a skilled practitioner to both identify Type I strong base anion exchange resin and identify the difference between Type I and Type II strong base anion exchange resins.

21. Documents F-K are fact sheets relating to various strong base anion exchange resins sold by Purolite. Document F (A-500 and A-500P) and Document G (PFA-400) are fact sheets for two Purolite Type I strong base anion exchange resins. Both documents show, on the "Functional Groups" line in the shaded area, that these Type I strong base anion exchange resins have the $R(CH_3)_3N^+$, i.e., trimethylamine, functional group. Document F is dated "5/92" at the lower right corner of the last page.

22. Documents F and G indicate the swelling expected when the resin is converted from the Cl^- form to the OH^- form ("Swelling ($Cl \rightarrow OH$)" in Document F, "Maximum Swelling, $Cl^- \rightarrow OH^-$" in Document G).

23. Documents H (A-510), I (A-200), J (A-300, A-300E), and K (PFA-300) are fact sheets for four Purolite Type II strong base anion exchange resin products. Documents H-J indicate, in the shaded area, that the Functional Groups are $RN^+(CH_3)_2(C_2H_4OH)$, i.e., the dimethylethanolamine group. The same is indicated in Document K by the line "Functional Groups .... $R\text{-}(CH_3)_2(C_2H_4OH)N^+$". Document H is dated "4/92" in the lower right corner of the last page.

24. Documents H and K indicate the swelling expected when the resin is converted from the Cl^- form to the OH^- form. See the lines "Swelling CL [sic] $\rightarrow$ OH^-" on Document H and "Maximum Swelling, $Cl^- \rightarrow OH^-$" on Document K. Documents I

and J indicate the same characteristic at the line "Swelling (Salt → OH)." The salt form is the Cl^- form.

25. Documents F-K directly contradict Crovato's suggestion regarding the difference between Type I and Type II strong base anion exchange resins because the documents show that both types of strong base anion exchange resins exist in both the Cl^- and the OH^- forms.

26. Documents F-K contradict Crovato's suggestion and show that the difference between Type I strong base anion exchange resin and Type II strong base anion exchange resin lies in the structure of the functional group. Documents F-K also enable a skilled practitioner to both identify Type II strong base anion exchange resin and identify the difference between Type I and Type II strong base anion exchange resins.

27. Documents B, C, D, E, F, and H enabled the skilled practitioner to identify a Type II strong base anion exchange resin and the difference between a Type I strong base anion exchange resin and a Type II strong base anion exchange resin before the earliest filing date of the original application.

28. Document L (ION EXCHANGE, Principles and Applications) is a reprint from the Encyclopedia of Technical Chemistry, a reference volume about ion exchange. At page 397, left column, there are illustrated the structural formulas of Type I, Type II, and other strong base anion exchange resins (that do not have a "Type" associated with their structural formula). As set forth therein, Type I strong base anion exchange resin has the $-CH_2N^+(CH_3)_3$ trimethylamine functional group, and Type II strong base anion exchange resin has the $-CH_2N^+(CH_3)_2CH_2CH_2OH$ dimethylethanolamine group. Although Document L is undated, it was in MPR's possession when I joined the

company in May 1993. Document L does not relate to a specific product, but rather to Type I and Type II strong base anion exchange resins generally.

29. Document L contradicts Crovato's suggestion regarding the difference between Type I and Type II strong base anion exchange resins and shows that the difference between Type I strong base anion exchange resin and Type II strong base anion exchange resin lies in the structure of the functional group. Document L also enables a skilled practitioner to both identify Type II strong base anion exchange resin and identify the difference between Type I and Type II strong base anion exchange resins.

30. Document M (Fundamentals of Ion Exchange) is a transcript of an oral presentation given in March 1989, at the annual meeting of the Water Quality Association. Document M is directed to ion exchange technology generally; specific water treatment applications are described therein. The section headed STRONG BASE RESINS at pages 96-100 is the relevant portion of this document.

31. Document M describes Type 1 strong base anion exchange resin as the first type made, with Type 2 following. "Type 1" is the same as "Type I," and "Type 2" is the same as "Type II." Consistent with each of documents A-L, this document describes Type I strong base anion exchange resin as having trimethylamine as the functional group ("the exchange site") and Type II strong base anion exchange resin as having the functional group dimethylethanolamine, "which has an alcohol in place of one of the methyl groups." Document M, page 96, last paragraph.

32. Document M contradicts Crovato's suggestion regarding the difference between Type I and Type II strong base anion exchange resins and shows that the

difference between Type I strong base anion exchange resin and Type II strong base anion exchange resin lies in the structure of the functional group. Document M also enables a skilled practitioner to both identify Type I strong base anion exchange resin and identify the difference between Type I and Type II strong base anion exchange resins.

33. Documents A-M enable the skilled practitioner to identify Type II strong base anion exchange resin, and to distinguish Type II from Type I strong base anion exchange resin.

34. I have reviewed that portion of Perry's Chemical Engineers' Handbook, Fifth Edition provided with the Office Action, and particularly Fig. 16-8.

35. Fig. 16-8 sets forth representative types of experimental isotherms for physical adsorption. Five types of isotherms are illustrated.

36. The text associated with Fig. 16-8 describes these isotherms as being particular to the solute adsorption and desorption characteristics of a particular system. Further, as the term 'isotherm' indicates, these curves must be prepared for each temperature of interest. The text describes that these curves indicate whether adsorption of the solute is 'favorable' or 'unfavorable,' and hence whether desorption will be difficult or easy.

37. Nothing in the text from Perry's Handbook, Fifth Edition, describing these equilibrium isotherms relates to whether the adsorbent is ion exchange resin or any other adsorbent, such as charcoal or zeolite.

38. Nothing in this text from Perry's Handbook, Fifth Edition, relates to strong base anion exchange resin.

39. The isotherm types from Perry's Handbook, Fifth Edition, should not be confused with types of strong base anion exchange resins, because they are not related concepts. Rather, the isotherm types in the Handbook are representations of a solute concentration in a solid phase as a function of solute concentration or partial pressure in the fluid phase at a given temperature (hence the designation 'isotherm'). See pages 16-12 to 16-14 of the Fifth Edition text. These curves are not related to resin type, but rather to characteristics of a system. A skilled practitioner would not confuse these curves with resin types. The text accompanying Fig. 16-8 is clear, and clearly does not relate to strong base anion exchange resin types.

40. Document N includes a page of Table 16-6 from Perry's Chemical Engineers' Handbook, Seventh Edition. Type I and Type II resins are described under the heading "Anion Exchangers: strongly basic" and the subheading "Polystyrene-based." Type I is described as "Trimethylbenzyl ammonium," and Type II is described as "Dimethyl hydroxyethyl ammonium." These descriptions have the same meaning as the other descriptions and the structural formulas of Type I and Type II resins set forth in each of documents A-M and O filed with this declaration. Thus, the isotherm "type" designations in Perry's Handbook, Fifth Edition, are unrelated to and distinct from the "Type I" and "Type II" designations that relate to and identify the structure that imparts functionality to these strong base anion exchange resins. This teaching also contradicts Crovato.

41. Document O, "Essentials of Ion Exchange," is a printed version of a presentation of the Twenty-Fifth Annual Water Quality Association Conference on March 17, 1999. This document describes synthesis of ion exchange resins on the second

page. As described in the paragraph bridging the columns, "[t]he polystyrene-DVB bead needs to be chemically activated to make it perform as an ion exchange material. Active groups are attached to provide chemical functionality to the bead."

42. The paragraph at the center of the right column of the second page of Document O describes the reactions employed to attach functionality and form strong base anion exchange resins. As set forth, the resin is activated by chloromethylation followed by amination. Document O goes on to describe creation of the functionality of strong base anion exchange resins as follows:

> The type of amine used determines the functionality of the resin. A common amine used is trimethylamine (TMA), which creates a Type 1 strongly basic anion exchanger. Using dimethylethanolamine (DMEA) will make a Type 2 anion resin.

Thus, Document O describes manufacture of ion exchange resin, including attachment of functional group. The document describes the functional groups for Type 1 and Type 2 strong base anion exchange resins clearly and unambiguously, thus contradicting Crovato and enabling a skilled practitioner to identify such resins.

I declare that all statements made herein of my own knowledge are true and that I believe all statements made on information and belief are true and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

September 8, 2003
Date

Arthur L. Cummings

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